TETRA TECH

December 8, 2014

Mr. Bradley Vann
Remedial Project Manager
U.S. Environmental Protection Agency, Region 7
11201 Renner Boulevard
Lenexa, Kansas 66219

Subject: **Review Comments on Radon Flux Analysis, Attachment A of the Draft Isolation Barrier Alternatives Analysis**
West Lake Landfill Site, Bridgeton, Missouri
CERCLIS ID: MOD079900932
EPA Region 7, START 4, Contract No. EP-S7-13-06, Task Order No. 0058
Task Monitor: James Johnson, On-Scene Coordinator

Dear Mr. Vann:

Tetra Tech, Inc. is submitting the attached comments on the Attachment A (Radon Flux Analysis) of the Draft Isolation Barrier Alternatives Analysis prepared by Auxier & Associates, Incorporated. If you have any questions or comments, please contact me at (816) 412-1754, or Mr. Nathan Smith, CHP, RRPT, at (614) 332-5838.

Sincerely,

Ted Faile, PG, CHMM
START Program Manager

Enclosures

cc: Debra Dorsey, START Project Officer (cover letter only)

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**Comments on the Radon Flux Analysis (Attachment A) presented in the Draft Isolation Barrier Alternatives Analysis
West Lake Landfill Superfund Site
October 10, 2014**

General Comment 1

The concept of a heating event within radiological waste combined with its effect on the radiological conditions, specifically radon flux at the surface is complex. The specific arguments postulated in this document in relation to the heat's effect on the radiologically-impacted material (RIM) and therefore radon flux are well thought out and present plausible scenarios considering an event occurring is a low probability.

Specific Comment 1

One of the core concerns in regards to the concentrations of radionuclides at the site relates to the fact that the wastes accepted at the landfill contained an elevated ratio of Th-230 to uranium and radium. The uranium ore processing residues were the result of a process that was designed to separate out uranium and radium thereby leaving thorium in the residue (Sections 2.0 and 5.4.2 of the 2008 ROD). Th-230 is the parent radionuclide for Ra-226. Th-230 was found on the surface in Area 1 at a maximum concentration of 57,000 picoCuries per gram (pCi/g), while the maximum surface concentration for Ra-226 was 910 pCi/g (Table 5-2 of the 2008 Record of Decision [ROD]). The 95% upper confidence limit (UCL) for Th-230 of the arithmetic mean on the surface was 8,140 pCi/g, while the 95% UCL of the arithmetic mean for Ra-226 on the surface was 581 pCi/g (Table 7-1 of the 2008 ROD). The 95% UCL for Th-230 of the arithmetic mean at all depths was 1,060 pCi/g, while the 95% UCL of the arithmetic mean for Ra-226 at all depths was 71.6 pCi/g (Table 7-1 of the 2008 ROD).

In naturally occurring material Ra-226 and Th-230 will be in secular equilibrium with each other. However, the sampling results combined with the materials history indicate that Ra-226 and Th-230 are not in secular equilibrium at Area 1. Due to the relatively "short" half-life of Ra-226 (1,600 years) when compared with the much longer half-life of Th-230 (75,000 years), Ra-226 will effectively reach equilibrium with Th-230 in about 10,000 years. Because of this, it is important that when assessing the future risk and dose at the landfill the future concentration of Ra-226 should be considered.

The ingrowth of Ra-226 from the decay of Th-230 was identified as a concern in Section 7.2.2 of the 2000 Remedial Investigation (RI), and a sample calculation is provided for the Ra-226 concentration in Area 2 after 1,000 years. Going from the 189 pCi/g value for the 95% UCL for the arithmetic mean for Area 2, to 871 pCi/g after 1,000 years. Additionally, in Table 7-4 of the ROD the future 95% UCL concentration for Ra-226 in the surface soil and all depths for Area 1 at 1,000 years are shown to be 3,224 pCi/g and 417 pCi/g respectively. Furthermore, Table 2 of the 2011 Supplemental Feasibility study (FS) shows a summary of the Th-230 decay and Ra-226 ingrowth for Area 2. As can be seen on this table, the peak Ra-226 concentration occurs at around 10,000 years. This is further demonstrated in Figure 15 of the FS. In Appendix F of the Supplemental FS, the cover thickness calculations are verified by use of the same RAECOM web calculator referenced in Attachment A of the Isolation Barrier Alternatives Analysis document. Appendix F of the Supplemental FS uses the Ra-226 concentration at 1,000 years for the 95% UCL of all the data for Area 1 (which can also be found in in Table 7-4 of the ROD) when providing the input for the RAECOM calculator. One could argue that since the Ra-226 concentration will peak and be closer to the current Th-230 concentration in 10,000 years, the 10,000 year concentration should be used. However, radiological risk assessments are generally carried out to 1,000 years.

In all of the scenarios provided in Attachment A of the Isolation Barrier Alternatives Analysis document, the 95% UCL of the arithmetic mean for Ra-226 at all depths of 71.6 pCi/g for Area 1 (from the 2000 RI) was used without consideration of the ingrowth of Ra-226 due to the decay of Th-230. While it may be useful to consider current conditions, future concentrations of Ra-226 due to the decay of Th-230 should be taken into consideration.

Specific Comment 2

RIM was identified within 6 inches of the surface of Area 1 during the RI. The most elevated sample was identified on the surface. While the area identified with RIM present on the surface is smaller than that of the subsurface, any overburden thickness would be difficult to assess and in some portions of the site it is known to be zero. Attachment A assumes that an overburden exists across the site at 30 centimeters when performing the RAECOM calculations. However, when performing the calculations for the ROD selected remedy in Attachment A there is no overburden barrier assumed between the RIM and the remedy layers. The calculations for the cover thickness in Appendix F of the Supplemental FS do not calculate baseline conditions but rather mimic the ROD selected remedy calculation in Attachment A. In Appendix F of the Supplemental FS there is no assumed overburden between the RIM and the remedy. Calculation of the 95% UCL at all depths appears to include the surface sample results and is the basis of the RAECOM calculations. Section 2.2.2 of the 2011 Supplemental FS states the following:

"Radionuclides are present in surface soil (0-6 inches in depth) over approximately 50,700 square feet (1.16 acres) of Area 1. Approximately 194,000 square feet (4.45 acres) of Area 1 have radionuclides present in the subsurface at depths ranging up to 7 feet, with localized intervals present to depths of 15 feet."

Please provide an explanation as to why an overburden soil was assumed to be present for the baseline scenario and why it was assumed to be 30 centimeters.

Specific Comment 3

In section 2.2 of Attachment A the calculated radon flux from the current configuration of Area 1 is compared to the average measured value during the 2000 RI. It should be noted that while the average Radon Flux sample resulted in 13 picocuries per meter squared per second (pCi/m^2/s), 24 samples were collected and the three highest values were 245.9 pCi/m^2/s, 22.3 pCi/m^2/s and one was 8 pCi/m^2/s. The remainder were all below 1.9 pCi/m^2/s. The mode of the data is 0.2

pCi/m^2/s and the median is 0.4 pCi/m^2/s. With the 245.9 pCi/m^2/s value removed the average becomes 2 pCi/m^2/s. Therefor the 13 pCi/m^2/s average of the measured data does not compare well with the remainder of the measured data.

Specific Comment 4

Ra-226 is a naturally occurring isotope found in varying concentrations throughout the world. The background soil concentrations determined in the RI are around 1 pCi/g. The RAECOM calculations in Appendix F of the FS assumed that each remedy layer would consist of material that contained 1 pCi/g. Background concentrations of Ra-226 in soil can easily range between 0.5 and 3 pCi/g. It would be difficult to find soils that don't contain Ra-226. However, the RAECOM calculations included in Attachment A all assume the overburden, as well as the remedy layers, contain 0 pCi/g. Please provide an explanation for assuming the overburden and remedy layers contain no Ra-226 activity.

Specific Comment 5

In the Isolation Barrier Alternatives Analysis document, one of the disadvantages of some of the more intrusive alternatives is testing for thorium, requiring a 24-hour sample turnaround period. Depending on how plans are developed, standard Ra-226 analysis for soil has a 21-day turnaround (due to the in-growth of Bi-214) that could further complicate these alternatives.

Specific Comment 6

Another consideration for alternatives that require excavation into the RIM is that radiologically-impacted fugitive dust has the possibility of being generated and additional controls to mitigate this would need to be implemented. This would have an impact on cost, schedule and provide a potential risk to site workers.